CLAIMS

1. A transmitter apparatus comprising:

an input receiving section that receives inputs of multiple synchronized signals $r_1, \ldots, r_N$;

an asynchronizing section that delays the multiple input received synchronized signals $r_1, \ldots, r_N$ by time $t_1, \ldots, t_N$ to output multiple asynchronized signals $v_1, \ldots, v_N$;

a modulating section that modulates the output multiple asynchronized signals $v_1, \ldots, v_N$ to output modulated signals $w_1, \ldots, w_L (1 \leqq L \leqq N)$; and

a transmitting section that transmits the output modulated signals $w_1, \ldots, w_L$,

wherein the delay time $t_1, \ldots, t_N$ is shorter than a reciprocal number of a minimum value of clock rates of the multiple input received synchronized signals $r_1, \ldots, r_N$.

2. The transmitter apparatus according to claim 1, further comprising:

a storing section that stores the delay time $t_1, \ldots, t_N$ in advance,

wherein the asynchronizing section delays the respective multiple synchronized signals $r_1, \ldots, r_N$ by the time $t_1, \ldots, t_N$ stored in the storing section.

3. The transmitter apparatus according to claim 1, wherein the modulating section classifies the asynchronized signals $v_1, \ldots, v_N$ into L ($L \leqq N$) signal groups to send the respective classified L signal groups to any one of L spread spectrum modulators not to be overlapped with one another to output the modulated signals $w_1, \ldots, v_L$.

4. The transmitter apparatus according to claim 3, wherein the transmitting section radio-transmits the respective modulated signals $w_1, \ldots, w_L$ by L radio frequency modulators each using a different carrier frequency.

5. The transmitter apparatus according to claim 3, wherein the transmitting section sends the modulated signals $w_1, \ldots, w_L$ to I-channels and Q-channels of each of L/2 radio frequency modulators each using a different carrier frequency not to be overlapped with one another to radio-transmit the respective obtained transmitting signals.

6. The transmitter apparatus according to claim 3, wherein $L = 2$ is established.

7. The transmitter apparatus according to claim 1, wherein the delay time $t_1, \ldots, t_N$ is proportional to $u_1, \ldots, u_N$. that is determined by the following equation by a prestored integer value a and a predetermined nonlinear transformation $f(\cdot)$ over a finite field:

$u_1 = a;$

$u_{j+1} = f(u_j)\ (1 \leqq j < N).$

8. The transmitter apparatus according to claim 7, wherein the prestored value a is updated to $a = f(u_N)$ every time when predetermined time passes, and thereby the delay time $t_1, \ldots, t_N$ is updated.

9. The transmitter apparatus according to claim 7, wherein the predetermined nonlinear transformation $f(\cdot)$ over a finite field corresponds to any one of the following (a) to (e):

(a) transformation using a Chebyshev polynomial of second or more degree,

(b) transformation using Bernoulli mapping,

(c) transformation $f(x) = 2x^2 - px + q \pmod{2^w}$ defined using integers p, q ($p \bmod 4 = 1$, $0 \leqq q \leqq 2^w-1$),

(d) transformation using a remainder obtained by dividing any one of transformation

results of (a) to (c) by a predetermined integer, and

(e) transformation that is the same form as any one of the above (a) to (d) by a linear coordinate transformation.

10. A receiver apparatus comprising:

a receiving section that receives multiple signals as $a_1, \ldots, a_L$ ($1 \leqq L$);

a delaying section that delays the respective multiple received signals $a_1, \ldots, a_L$ by time $T - t_1, \ldots, T - t_N$ ($L \leqq N$) where T is predetermined constant time without being overlapped with one another to output multiple intermediate signals $p_1, \ldots, p_N$;

a demodulating section that demodulates the multiple output intermediate signals $p_1, \ldots, p_N$ to output demodulated signals $r_1, \ldots, r_N$; and

an outputting section that outputs the multiple output demodulated signals $r_1, \ldots, r_N$ as multiple transmitted synchronized signals.

11. The receiver apparatus according to claim 10, further comprising:

a storing section that stores the predetermined constant time T and time $t_1, \ldots, t_N$ in advance,

wherein the delaying section obtains delay time of the respective multiple synchronized signals $r_1, \ldots, r_N$ from time stored in the storing section and delays the synchronized signals by time $T - t_1, \ldots, T - t_N$.

12. The receiver apparatus according to claim 10, wherein the delaying section classifies the delay time $T - t_1, \ldots, T - t_N$ into L delay time groups, and uses the respective classified L delay time groups not to be overlapped with the received signals $a_1, \ldots, a_L$ to output the intermediate signals $p_1, \ldots, p_N$.

13. The receiver apparatus according to claim 12, where the receiving section obtains the respective received signals $a_1, \ldots, a_L$ from L radio frequency modulators each using a different carrier frequency.

14. The receiver apparatus according to claim 12, wherein the receiving section obtains the received signals $a_1, \ldots, a_L$ from I-channels and Q-channels of each of L/2 radio frequency modulators each using a different carrier frequency not to be overlapped with one another.

15. The receiver apparatus according to claim 14, wherein $L = 2$ is established.

16. The receiver apparatus according to claim 10, wherein the time $t_1, \ldots, t_N$ is proportional to $u_1, \ldots, u_N$. that is determined by the following equation by a prestored integer value a and a predetermined nonlinear transformation $f(\cdot)$ over a finite field:

$u_1 = a;$

$u_{j+1} = f(u_j)\ (1 \leqq j < N).$

17. The receiver apparatus according to claim 16, wherein the prestored value a is updated to $a = f(u_N)$ every time when predetermined time passes, and thereby the delay time $t_1, \ldots, t_N$ is updated.

18. The receiver apparatus according to claim 16, wherein the predetermined nonlinear transformation $f(\cdot)$ over a finite field corresponds to any one of the following (a) to (e):

(a) transformation using a Chebyshev polynomial of second or more degree,

(b) transformation using Bernoulli mapping,

(c) transformation $f(x) = 2x^2 - px + q \pmod{2^w}$ defined using integers p, q (p mod 4 = 1, $0 \leqq q \leqq 2^w-1$),

(d) transformation using a remainder obtained by dividing any one of transformation results of (a) to (c) by a predetermined integer, and

(e) transformation that is the same form as any one of the above (a) to (d) by a linear coordinate transformation.

19. A transmission method comprising:

the input receiving step of receiving inputs of multiple synchronized signals $r_1, \ldots, r_N$;

the asynchronizing step of delaying the multiple input received synchronized signals $r_1, \ldots, r_N$ by time $t_1, \ldots, t_N$ to output multiple asynchronized signals $v_1, \ldots, v_N$;

the modulating step of modulating the output multiple asynchronized signals $v_1, \ldots, v_N$ to output modulated signals $w_1, \ldots, w_L$ ($1 \leqq L \leqq N$); and

the transmitting step of transmitting the output modulated signals $w_1, \ldots, w_L$,

wherein the delay time $t_1, \ldots, t_N$ is shorter than a reciprocal number of a minimum value of clock rates of the multiple input received synchronized signals $r_1, \ldots, r_N$.

20. The transmission method according to claim 19,

wherein a storing section that stores the delay time $t_1, \ldots, t_N$ in advance is used; and

wherein the respective multiple synchronized signals $r_1, \ldots, r_N$ are delayed by the time $t_1, \ldots, t_N$ stored in the storing section in the asynchronizing step.

21. The transmission method according to claim 19, wherein the asynchronized signals $v_1, \ldots, v_N$ are classified into L ($L \leqq N$) signal groups and the respective classified L signal groups are sent to any one of L spread spectrum modulators not to be overlapped

with one another to output the modulated signals w_1, …, v_L in the modulating step.

22. The transmission method according to claim 21, wherein the respective modulated signals w_1, …, w_L are radio-transmitted by L radio frequency modulators each using a different carrier frequency in the transmitting step.

23. The transmission method according to claim 21, wherein the modulated signals w_1, …, w_L are sent to I-channels and Q-channels of each of L/2 radio frequency modulators each using a different carrier frequency not to be overlapped with one another to radio-transmit each of the obtained transmitting signals in the transmitting step.

24. The transmission method according to claim 23, wherein $L = 2$ is established.

25. The transmission method according to claim 19, wherein the delay time t_1, …, t_N is proportional to u_1, …, u_N. that is determined by the following equation by a prestored integer value a and a predetermined nonlinear transformation $f(\cdot)$ over a finite field:

$u_1 = a$;

$u_{j+1} = f(u_j)\ (1 \leqq j < N)$.

26. The transmission method according to claim 25, wherein the prestored value a is updated to $a = f(u_N)$ every time when predetermined time passes, and thereby the delay time t_1, …, t_N is updated.

27. The transmission method according to claim 25, wherein the predetermined nonlinear transformation $f(\cdot)$ over a finite field corresponds to any one of the following (a) to (e):

(a) transformation using a Chebyshev polynomial of second or more degree,

(b) transformation using Bernoulli mapping,

(c) transformation $f(x) = 2x^2 - px + q \pmod{2^w}$ defined using integers p, q (p mod 4 = 1, $0 \leqq q \leqq 2^w-1$),

(d) transformation using a remainder obtained by dividing any one of transformation results of (a) to (c) by a predetermined integer, and

(e) transformation that is the same form as any one of the above (a) to (d) by a linear coordinate transformation.

28. A reception method comprising:

the receiving step of receiving multiple signals as $a_1, \ldots, a_L$ ($1 \leqq L$);

the delaying step of delaying the respective multiple received signals $a_1, \ldots, a_L$ by time $T - t_1, \ldots, T - t_N$ ($L \leqq N$) where T is predetermined constant time without being overlapped with one another to output multiple intermediate signals $p_1, \ldots, p_N$;

the demodulating step of demodulating the multiple output intermediate signals $p_1, \ldots, p_N$ to output demodulated signals $r_1, \ldots, r_N$; and

the outputting step of outputting the multiple output demodulated signals $r_1, \ldots, r_N$ as multiple transmitted synchronized signals.

29. The reception method according to claim 28,

wherein a storing section that stores the predetermined constant time T and time $t_1, \ldots, t_N$ in advance is used; and

wherein delay time of the respective multiple synchronized signals $r_1, \ldots, r_N$ is obtained from time stored in the storing section and the synchronized signals are delayed by the time $T - t_1, \ldots, T - t_N$ in the delaying step.

30. The reception method according to claim 28, wherein the delay time $T - t_1, \ldots, T - t_N$ are classified into L delay time groups, and the respective classified L delay time groups are used not to be overlapped with the received signal $a_1, \ldots, a_L$ to output the intermediate signals $p_1, \ldots, p_N$ in the delaying step.

31. The reception method according to claim 30, where the respective received signals $a_1, \ldots, a_L$ are obtained from L radio frequency modulators each using a different carrier frequency in the receiving step.

32. The reception method according to claim 30, wherein the received signals $a_1, \ldots, a_L$ are obtained from I-channels and Q-channels of each of L/2 radio frequency modulators each using a different carrier frequency not to be overlapped with one another in the receiving step.

33. The reception method according to claim 32, wherein $L = 2$ is established.

34. The reception method according to claim 28, wherein the time $t_1, \ldots, t_N$ is proportional to $u_1, \ldots, u_N$. that is determined by the following equation by a prestored integer value a and a predetermined nonlinear transformation $f(\cdot)$ over a finite field:

$u_1 = a;$

$u_{j+1} = f(u_j)\ (1 \leqq j < N).$

35. The reception method according to claim 34, wherein the prestored value a is updated to $a = f(u_N)$ every time when predetermined time passes, and thereby the delay time $t_1, \ldots, t_N$ is updated.

36. The reception method according to claim 34, wherein the predetermined nonlinear transformation $f(\cdot)$ over a finite field corresponds to any one of the following (a) to (e):

(a) transformation using a Chebyshev polynomial of second or more degree,

(b) transformation using Bernoulli mapping,

(c) transformation $f(x) = 2x^2 - px + q \pmod{2^w}$ defined using integers p, q (p mod 4 = 1, $0 \leqq q \leqq 2^w - 1$),

(d) transformation using a remainder obtained by dividing any one of transformation results of (a) to (c) by a predetermined integer, and

(e) transformation that is the same form as any one of the above (a) to (d) by a linear coordinate transformation.

37. A program causing a computer (including FPGA (Field Programmable Gate Array), DSP (Digital Signal Processor), ASIC (Application Specific Integrated Circuit)) to function as the respective sections described in claim 1.

38. A program causing a computer (including FPGA (Field Programmable Gate Array), DSP (Digital Signal Processor), ASIC (Application Specific Integrated Circuit)) to function as the respective sections described in claim 10.